New Green Chemistry Iridium Catalysts

Kienle, Benedikt (School: Lancaster Country Day School)

N-heterocyclic carbenes (NHCs) have emerged as excellent spectator ligands in homogeneous catalysis, especially in transfer hydrogenation reactions. Transfer hydrogenation, the reduction of unsaturated bonds, is a reaction of great interest and exemplifies key aspects of Green Chemistry. NHC ligands can be tuned sterically and electronically by having different alkyl groups on the nitrogen atoms. In this project, new imidazole-based iridium NHC complexes were synthesized via high-yielding air-stable procedures. A neutral iridium complex was synthesized by transmetallation from an Ag(I) complex, and subsequently three more cationic complexes were isolated by treating the neutral complex with different ancillary ligands and silver tetrafluoroborate. All four complexes were characterized by multinuclear NMR and X-ray diffraction studies. All the complexes exhibit a distorted square-planar geometry around the Iridium(I) ion. All three of the new cationic complexes synthesized in this project exhibited excellent catalytic activity of up to 100% yield for the transfer hydrogenation reduction of C=O and C=N bonds with 2-propanol. These NHC complexes have numerous potential applications in industrial and pharmaceutical processes and may be used as effective catalysts in Green Chemistry.

Awards Won:

First Award of $6,000

Herschbach SIYSS Award

YM American Academy: Third Award of $500.00

Westlake University: Five outstanding students will be given priority with full scholarships for four years of undergraduate admissions, applicable to any major, at Westlake University.

American Chemical Society: Second Award of $3,000